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REFINED MODELS FOR AN ANALYSIS OF INTERNAL AND EXTERNAL BUCKLING MODES OF A MONOLAYER IN A LAYERED COMPOSITE

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For an analysis of internal and external buckling modes of a monolayer inside or at the periphery of a layered composite, refined geometrically nonlinear equations are constructed. They are based on modeling the monolayer as a thin plate interacting with binder layers at the points of boundary surfaces. The binder layer is modeled as a transversely soft foundation. It is assumed the foundations, previously compressed in the transverse direction (the first loading stage), have zero displacements of its external boundary surfaces at the second loading stage, but the contact interaction of the plate with foundations occurs without slippage or delamination. The deformation of the plate at a medium flexure is described by geometrically nonlinear relations of the classical plate theory based on the Kirchhoff–Love hypothesis (the first variant) or the refined Timoshenko model with account of the transverse shear and compression (the second variant). The foundation is described by linearized 3D equations of elasticity theory, which are simplified within the framework of the model of a transversely soft layer. Integrating the linearized equations along the transverse coordinate and satisfying the kinematic joining conditions of the plate with foundations, with account of their initial compression in the thickness direction, a system of 2D geometrically nonlinear equations and appropriate boundary conditions are derived. These equations describe the contact interaction between elements of the deformable system. The relations obtained are simplified for the case of a symmetric stacking sequence.

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